Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-01	New Castle County was not provided with access to the model development process and was not provided with enough access to the model.	New Castle County was provided with the model on October 14, 2003, four days after the opening of the public comment period. Since the comment period was extended by one week, New Castle County had over 30 days to review the model. EPA provided assistance to New Castle County's contractor in operating the model.
Surles, Tracy	01-02	We see no reason why EPA did not have the TMDL and all supporting information ready for review by the public at the start of the 30-day comment period.	The TMDL was posted on the web at the start of the comment period. The model and Appendix B (DNREC's 2001 report) were not available on the web but were available upon request. The model was e-mailed to New Castle County on October 14, 2003. Since the comment period was extended by one week, New Castle County had over 30 days to review the model. Appendix B contained DNREC's 2001 report (the commentor mentioned they had commented upon this document) would have been furnished to the County upon request, however EPA was never contacted by the County in regards to the appendix even though it was contacted several times about the model.
Surles, Tracy	01-03	EPA has failed to provide important information for the public comment. EPA's approach left the public with little meaningful opportunity to comment on the accuracy of all of the modeling information.	EPA provided the public with over thirty days to review the TMDL and was available for contact after the release of the TMDL. New Castle County requested assistance from EPA on running the model. EPA provided this assistance quickly and in a professional manner.
Surles, Tracy	01-04	The Appoquinimink system is extensively influenced by marshes. EPA and DNREC should be aware of the several studies about the system and the previous technical information that was provided to DNREC during the public comment opportunity.	EPA is aware of the marsh systems associated with the Appoquinimink River. EPA believes that it was able to accurately characterize the stream system through the use of the models in the TMDL as evidenced in the calibration and validation process. Even though the model did not explicitly account for the marshes it still reflected the stream's conditions.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-05	The TMDL fails to address the marshes either from a hydraulic or water quality perspective. The model cannot yield dependable results without addressing the marshes.	Water quality monitoring data focused on evaluating the specific impacts of the tidal marshes were not available to support this study. As such, detailed processes associated with the marshes were not explicitly represented in the receiving water modeling framework (DYNHYD and WASP). Landuse data were available for the watershed, and thus the wetland areas (marshes) were represented as a distinct landuse category in the GWLF modeling framework. Because insufficient monitoring data were available to fully define the impact (in terms of a net gain or loss) of the wetlands, neither the detainment capacity nor loading processes were explicitly considered. The comment assumes the TMDL fails to account for the contribution of nutrients to the watershed from adjacent marshes. It is well-documented, however, that wetlands perform a nutrient uptake function by detaining land-based loads prior to their reaching the river. In this case, there is no data specific to marshes in the Appoquinimink River watershed, either as to the contribution or nutrients from those marshes or as the impact of the nutrient uptake functions performed by those marshes. Accordingly, while the GWLF model included wetlands as a distinct land use category, specific data as to detention in the marshes of land-based constituent loads from the watershed, which in a good portion of the Appoquinimink River watershed pass through wetlands prior to feeding into the rivers (and tributaries), were not considered. At the same time, contributions of nutrients and organic matter from the wetlands themselves were also not explicitly represented. Because the model was successfully calibrated through a comparison of predictions with in-stream monitoring data and did not indicate a major contributing source was being overlooked, it is reasonable to assume that contributions from the marshes was balanced by the nutrient uptake function in terms of loading to the river.
Surles, Tracy	01-06	The net effect of forcing the model to fit observed data, while ignoring the marshes, results in incorrectly attributing the impacts of the marshes to other sources	Please see response 01-05.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-07	The sensitivity analysis clearly demonstrates that the system is sensitive to SOD. The model treats SOD as a constant sink of D.O. associated with the bottom area of the stream. Because the impact of the marshes can be, at least partially conceptualized as a periodic expansion of the inundated area that exerts SOD, this should have been a signal that the marshes could not be neglected.	Water quality monitoring data focused on evaluating the specific impacts of the tidal marshes (including the ability to lower DO in the river) were not available to support this study. The SOD was predicted using a sediment diagenesis model, and thus cannot physically be "inflated." The SOD was predicted based on a combination of factors, including loadings from the entire watershed and MOT and hydrologic regime.
Surles, Tracy	01-08	Because the DO standard for the river is not met due to the natural conditions, EPA should have done a use attainability analysis to identify the attainable D.O. level before doing a TMDL to achieve the standard.	To the extent the commenter argues that the TMDL is flawed because the applicable water quality standard is inherently deficient and could not be satisfied under any circumstance, the commenter's concerns are properly addressed to DNREC and not to this TMDL. TMDLs must, by law, be calculated to implement state water quality standards. This TMDL is an inappropriate forum for seeking a change in the state's water quality standards or the initiation of a use attainability analysis. Section 303(d)(1)(A) requires the State to identify waters for which technology-based limits are insufficient "to implement any water quality standard applicable to such waters." Section 303(d) is not an appropriate vehicle for disputing the appropriateness of specific State water quality standards. The appropriate vehicle for rectifying concerns regarding the appropriateness of a State water quality standard is EPA's authorities under Section 303(c). Under Delaware law implementing Section 303(c), water quality standards must be adopted as regulations through the state's normal notice-and-comment procedure. See Delaware WQS § §5.1, 5.2 (B-36-37). Any changes to a water quality standard must therefore also be adopted by the state through formal regulatory channels; in addition, any such changes must be approved by EPA. Id. Unless and until the the applicable water quality standard is changed pursuant to Section 303(c), it remains the only legally valid standard in place and the one that must be satisfied under Section 303(d). Nothing in the TMDL prevents DNREC from initiating a use attainability analysis.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-09	Why did EPA choose to ignore the attainability question given EPA's 1994 case study on the Appoquinimink River?	The conclusions of the 1994 study call on the following; to define the load reductions necessary to meet the DO criteria; further characterize nonpoint source nutrient loads; monitor and model the SOD; and specify how the TMDL will be implemented. The new TMDL is based on a new model which accounts for SOD and nonpoint sources of nutrients. The model also identifies the nutrient reductions that are necessary to attain the criteria.
Surles, Tracy	01-10	The applicable DO standard depends on whether the river is considered fresh or marine. EPA should recommend to DNREC that it specify the application of the marine standard.	EPA chose to develop the TMDL using the freshwater criteria. This is consistent with previous TMDL decisions by the state and EPA and is supported by the water quality data. As stated in the Technical Analysis for the Proposed Appoquinimink River TMDLs - October 2001, "the average salinity in the section of the Appoquinimink River between the confluence with the Delaware River and the intersection with Drawer Creek is above the saltwater salinity value of 5 ppt, but because the minimum is below the 5 ppt level, it is considered fresh water." EPA used Delaware's interpretation of their criteria for the TMDL endpoint.
Surles, Tracy	01-11	DNREC's data from 1997-2000 shows an average summer salinity: indicative of marine conditions as far as 5 km upstream from the Delaware River. For these areas, the draft TMDLs are more stringent than necessary and likely unattainable.	The summer salinity data reviewed by EPA showed that the salinity concentrations associated with fresh water criteria were more appropriate for the Appoquinimink River. Please see comment 1-10 for additional information.
Surles, Tracy	01-12	The TMDLs are being designed to meet critical (7Q10) conditions, when by definition there is extremely low fresh water flow. Therefore, it would be appropriate for these TMDLs to be designed to meet the marine D.O. standard- which is more likely the correct and attainable standard than the more stringent fresh water standard, especially in the lower portion of the river.	The current Appoquinimk TMDL was not developed for the 7Q10 flow, but was developed using a dynamic model which takes into account various storm and flow data. Therefore, it is more appropriate to use the fresh water criteria since this represents the stream condition.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-13	The use of the 5.0 mg/L marine DO standard is further supported by the natural background conditions of the river. As explained in the County's March 13, 2002 letter to Hearing Officer Rod Thompson, historical data demonstrate that th 5.5 mg/L standard cannot be achieved under critical conditions because of naturally occurring and other background conditions that have not been factored into the model. The basic problem is that the BOD, nutrients and SOD produced by surrounding salt marshes significantly reduce DO to the point that the river cannot meet the 5.5 mg/L standard. The TMDLs do not reflect this.	The model shows that the reduction in loadings called for in the TMDL will allow the Appoquinimnk River to attain the DO criteria for fresh water systems. EPA applied the fresh water criteria which was used by the state and EPA in previous TMDLs and is an appropriate interpretation of the DO criteria.
Surles, Tracy	01-14	DNREC has not specified that the marine standards should apply in the lower portion of the river. We believe that good science supports such a conclusion. EPA should initiate a UAA to address this issue.	DNREC has interpreted Delaware's water quality standard as applying the freshwater criteria. As a general matter, EPA will defer to a State's interpretation of its own water quality standard regulations, so long as that interpretation falls within the range of reasonable interpretations. In this case, DNREC determined to apply the freshwater criteria. DNREC's interpretation falls within the range of reasonable interpretations and is accepted by EPA. To the extent the commenter argues that the TMDL is flawed because the applicable water quality standard is inherently deficient and could not be satisfied under any circumstance, see response to 01-08. (Data Supporting this Decision)
Surles, Tracy	01-15	The available STORET data supports this view. DO levels during the June- September time frame during 2000-2001 fell below the 5.5 mg/L standard a significant amount of the time. At station 109121 90% of the DO values were below 5.5 mg/L. Almost every station we looked at had a significant number of samples below the standard. These results are almost certainly attributable to the marsh impacts.	Marsh impacts maybe impacting the DO concentration in the Appoquinimink River as stated in these comments. However, the marsh impacts are not the only factor impacting the low DO values. The model demonstrates that by reducing the elevated nutrient load that is reaching the River the DO impairment can be removed. The DO impairment is being impacted by both flow and load issues. To the extent the commenter implies the River will not be able to maintain the applicable criteria because of marsh related issues without addressing the excess nutrient loading, the comment does not reflect all conditions to the stream.
Surles, Tracy	01-16	The TMDL should be developed for both the 5.5 mg/L and 5.0 mg/L potential water quality standards.	The regulations require the TMDL to be developed for the applicable criteria therefore, the TMDL was developed for the DO concentrations associated with the fresh water criteria, 5.5mg/L.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-17	The Clean Water Act does not authorize EPA to make allocation decisions which have land use implications but preserves the role of state and local authorities in these matters.	To the extent the commenter suggests that, through the TMDL, EPA is impinging on State and local government's sovereignty to make local land use decisions, the commenter is mistaken. The commenter mistakenly equates the water quality-based approach with a regulatory control function. TMDLs established pursuant to Section 303(d) of the Clean Water Act merely afford EPA and the States the authority to identify all sources of impairments of water quality standards (point source and nonpoint source). A variety of allocation scenarios may achieve the water quality standard for the Appoquinimink River. The TMDL provides a breakout of the total loads for to the point sources and nonpoint sources and represents one allocation scenario. DNREC retains significant discretion as to how to implement the TMDL. As implementation of the established TMDL proceeds, DNREC may find that the applicable water quality standard can be achieved through other combinations of point and nonpoint source allocations that are more feasible and/or cost effective. If that happens, DNREC is free to re-run the model to propose a revised TMDL with an alternative allocation scenario that will achieve water quality standards. These procedures should be followed even if the sum of the loads remains identical. By transferring the loadings from one source to another the results of the model may change. The proximity and timing of the different sources impacts the river differently.
Surles, Tracy	01-18	EPA should include a chart that shows the available loadings for the limited parameters as well as the percent allocation between point and nonpoint sources as well as any margin of safety and reserved growth loadings.	Table 4-1 presents the available loadings for nonpoint sources (in the WLA column) and Table 4-2 presents the available loadings for point sources. The Margin of Safety was implicit, and thus not explicitly quantified. Therefore, it was not presented in the tables. No assignment was made to reserved loadings for growth.
Surles, Tracy	01-19	EPA should expressly acknowledge in the TMDL that any other allocation scenario that meets the total loadings is allowable within DNREC's discretion.	See response to 01-17.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-20	The sensitivity analysis is grossly inadequate. It does not provide any meaningful insight into how the system reacts to alternate input scenarios.	Although the sensitivity of modeling parameters and source contributions were evaluated during the model calibration/validation and allocation efforts, respectively, a full sensitivity analysis (which is not a regulatory requirement) was not presented in the TMDL report. The model was made available to the public, so that the public would have the ability to make sensitivity runs as they see fit.
Surles, Tracy	01-21	We would like to have seen sensitivity runs using different pollutant concentrations from our MOT treatment plant.	While the commenter suggests that there should have been additional sensitivity runs, the commenter failed to propose any alternative allocation scenarios, other than the commenter's request in its letter dated September 2, 2003 (which was based on an August 2003 meeting between New Castle County and EPA) seeking an allocation scenario that would increase the effluent from the MOT plant by a factor of 5. At the commenter's request, EPA ran the model increasing the loading from the MOT plant by the values requested in the letter. The model predicted that these loadings (CBOD 104 lbs/day, TN 104 lbs/day, TP 83 lbs/day) from the MOT plant would cause a failure to achieve water quality standards, even if the storm water sources were reduced by the amount called for in the TMDL. Accordingly, a WLA was selected that did not require a reduction from the MOT plant. As stated in response to 01-17, the TMDL represents one allocation scenario, and DNREC remains free to re-run the model and propose a revised TMDL with a different allocation scenario.
Surles, Tracy	01-22	Why was an effluent DO value of 0.695 mg/L used for the MOT plant when it has not discharged at such a low level. A more appropriate level in the range of 5 to 7 mg/L should have been evaluated.	A DO value of 0.695 mg/L was used for the MOT discharge to be consistent with DNREC=s original DYNHYD-WASP model of the Appoquinimink River. This value was used as part of the 1998 TMDL, increasing the DO concentration in the effluent is not expected to impact the model results.
Surles, Tracy	01-23	EPA did not provide enough time for the public to access the model and run alternative allocations.	EPA did provide an adequate amount of time and assistance in the public comment period. Please see responses to comment 1.
Surles, Tracy	01-24	Why does the model not reflect seasonal nitrogen inputs to the Appoquinimink River from the emergent herbaceous wetlands which represent 9.82% of the land use in the watershed.	Emergent and Woody Wetlands were assumed to have no net load contribution due to their capacity to detain and/or utilize nutrient inputs (since these processes were not explicitly represented in the modeling framework). See response to 01-05.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-25	Routine, scientifically correct investigations, from 1995 to the present of the chemistries and fishes in the Appoquinimink by DNREC demonstrate that the aquatic life use is being protected throughout the Appoquinimink. This is despite the fact that DO's below the minimum criteria are routinely measured.	Section 303(d) requires that each state identify and develop TMDLs for those waters for which technology-based effluent limitations are not stringent enough to implement "any water quality standard applicable to such waters." Applicable water quality standards includes narrative criteria, numeric criteria, use designations and anti-degradation. All four parts of the water quality standard must be considered. In this case, although there may be studies showing that the Appoquinimink River supports aquatic life, the evidence also shows that the river fails to achieve the numeric criteria for DO. Waters which fail to attain their numeric criteria must be listed on the Section 303(d) List as impaired for TMDL development. The attainment of a healthy benthic community does not cancel out the violations to the DO criteria.
Surles, Tracy	01-26	Why is the wetlands tidally influenced reduction of DO concentrations not listed as a factor contributing to lower DO concentrations in the river? Why is an inflated SOD used to compensate for the lack of wetlands influenced reduction in DO?	Water quality monitoring data focused on evaluating the specific impacts of the tidal marshes (including the ability to lower DO in the river) were not available to support this study. The SOD was predicted using a sediment diagenesis model, and thus cannot physically be "inflated." The SOD was predicted based on a combination of factors, including loadings from the entire watershed and MOT and hydrologic regime.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-27	Please provide a numerical example of the conversion of monthly GWLF TN and TP outputs to daily values. Please explain how the model mathematically calculates the interaction between wetlands functions and rainfall related runoff events to the river's mainstem.	The conversion of monthly GWLF outputs to daily was performed as follows: Assuming: ~ there are 30 days in a month ~ the monthly load of constituent X is 1,000 lb/month ~ monthly average flow is 3 cms ~ during the month there are only two rainfall events of 6 inches and 8 inches, respectively, on day 7 and day 11. Therefore, the total rainfall during the month is 14 inches. For those days without rainfall, a baseflow was first assumed (0.1 cms), thus the total flow for the 28 days without rainfall was 0.1 x 28 = 2.8 cms (cms is used instead of cubic meters for simplicity). The total flows for the other two days was thus (3 x 30) - 2.8 = 87.2 cms. Assuming the flow is directly proportional to rainfall, the flow on day 7 is: (6 inch/14 inch) x 87.2 = 37.3 cms; and the flow on day 11 is: (8 inch/14 inch) x 87.2 = 49.9 cms. Due to the inherent uncertainty in these estimates, the fact that the resulting storm flows are attenuated with respect to the rainfall values, and the ultimate goal of predicting water quality trends over time in the river system due to storm flow and low flow conditions, these estimates were distributed over a multiple-day time period. This is a common practice in water quality modeling studies (such as in Deas and Orlob, 1999), where specific flow and water quality loads or concentrations for all individual storms are not monitored (and thus must be predicted). Based on the first estimate of the flow, the flow time series is distributed over time using a weighted moving average scheme, where the flow on day n is represented as: Sum w(i)*Flow(n-K) from i--k to k. Where: the weight vector w(i) is determined based on a triangular formula as w(-2)=0.1, w(-1)=0.2, w(0)=0.4, w(1)=0.2, and w(2)=0.1. As boundary condition, the Newflow(1) and Newflow(2) should be equal to the Flow(1) and Flow(2).

			By using this linear formula, the flow on day 3 is calculated as: Newflow(7)=0.1*flow(5)+0.2*flow(6)+0.4*flow(7)+0.2*flow(8)+0.1*flow(9)=0.1*0.1+0.2*0.1+0.4*37.3+0.2*0.1+0.1*0.1=0.01+0.02+14.9+0.02+0.01=14.96 cms Newflow(8)=0.1*flow(6)+0.2*flow(7)+0.4*flow(8)+0.2*flow(9)+0.1*flow(10)=0.01+7.46+0.04+0.02+0.01=7.54 cms Using this formula, the distributed time series can be obtained for each day of the month. Then, the total load of 1,000 lbs is distributed to each day based on the assumption that the load of each day is proportional to the flow on that day. There is no explicit hydrodynamic representation of the wetlands, however tidal influences are simulate.
Surles, Tracy	01-28	Will appendix B provided with the final document?	Appendix B was available during the comment period; it simply was not on the web site. Although it was not on the web site, New Castle County requested and received the model. Appendix B also could have been requested and would have been provided. New Castle County did not, however, request a copy of Appendix B during the comment period. The Appendix will be furnished to the commenter at this time.
Surles, Tracy	01-29	What is the source of SOD that is introducing nutrients to the water column? Would rainfall related runoff sediments be trapped in the surrounding wetlands? Under the BNR conditions for the MOT previously provided to EPA would not MOT effluent be viewed as an insignificant source?	The source of the SOD is the organic matter loading from the watershed and the internal organic matter loading from algae death. Some of the watershed contributions are expected to be trapped in the surrounding wetlands, however, no information was available to accurately quantify the influence of the wetlands. Therefore, the wetlands were not explicitly represented in the modeling framework. The entire watershed load generated by the GWLF model was input directly into the DYNHYD- WASP model as a conservative assumption. MOT effluent would not be viewed as an insignificant source under the BNR conditions provided since it is responsible for more than 1% of the nitrogen and phosphorous loadings.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-30	Why is the Gaussian temperature function considered to be more representative of real algal growth? We question whether the lack of algal growth in the summer is due to temperature and whether algae are limited by nutrients as claimed in the TMDL.	Algae, depending on species, typically grows the fastest when temperature is within the optimal range (given other condition are also optimal). When temperature is lower or higher than the optimal range, growth is generally reduced. This trend is well represented by the Gaussian function. Recent, advanced models use the Gaussian temperature function instead of the power function (Park et al, 1995; HydroQual, 2001). Algae growth is influenced by many factors, including temperature, nutrient levels, and light availability. Because no specific data were available regarding light availability, and because light availability was not expected to vary drastically between the calibration and validation periods, it was assumed that temperature and nutrient concentrations were the primary factors. Thus, the model reflected these influencing factors and successfully predicted chlorophyll a concentrations. Nutrient loads throughout the year (including summer and fall) were predicted by the GWLF model. Thus, variability in nutrient levels (combined with flow) contributed by the watershed to the river was explicitly represented in the modeling framework. General observations regarding wetland functions are insufficient to explain cholorophyll-a concentrations in the Appoquinimink system under the calibration and validation conditions. The model predicts algae based on a host of factors specific to the Appoquinimink River system under specific conditions.
Surles, Tracy	01-31	Please explain why the use of a Kd decay rate value of 0.10/day resolves the previous model inconsistencies. What is the source and explanation for the selected Kd rate and why is it applicable to this river?	Previously, the Kd value was set as 0.075/day, while the CBODu/CBOD5 ratio was set as 1.58. A Kd value of 0.075/day, however, is associated with a CBODu/CBOD5 ratio of approximately 3.2. In the current version of the model, Kd was set to 0.1/day (and CBODu/CBOD5 was set to 2.54). This Kd was set through calibration and based on the consideration that the sole point source along the river discharges secondary treatment effluent, while the remainder of contributions are from the watershed (land) itself. In Lung, 2001, it is stated that in a river where secondary treatment effluent discharges and other sources are nonpoint source, the Kd can be as low as 0.075/day. Using a significantly higher Kd value would likely overestimate the impact of CBOD.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-32	Please include the phytoplankton monitoring data in the TMDL technical document.	The phytoplankton monitoring data are shown graphically on the plots in Appendix C of the TMDL report. A table has been added as per your request.
Surles, Tracy	01-33	Lacking a wetlands component in the model, does the sediment diagenesis model have to overcompensate the DO reduction associated with the sediment?	No, the sediment diagenesis model does not overcompensate the DO reduction associated with the sediment, because it only responds to the organic load coming into the river from the watershed and MOT. Some of the watershed contributions are expected to be trapped in the surrounding wetlands, however, no information was available to accurately quantify the influence of the wetlands. Therefore, the wetlands were not explicitly represented in the modeling framework. The entire watershed load generated by the GWLF model was input directly into the DYNHYD- WASP model as a conservative assumption.
Surles, Tracy	01-34	Please provide the monitoring data base and calculations that support the method by which the GWLF TN and TP outputs were converted to nitrate-nitrite, ammonium, organic nitrogen, orthophosphate and organic phosphorous loads.	Ratios among nutrient components (e.g., individual nitrogen components vs. total nitrogen) for boundary conditions in the existing DNREC model were used to convert the TN and TP outputs from the GWLF model into individual nutrient components. The ratios in the DNREC model were based on an analysis of water quality data. Although each modeling segment had been assigned a unique ratio in the DNREC model, the mean ratio of all segments was calculated and used to convert GWLF output into constituents for the WASP model. The final ratios used are presented on page 4-5 of the TMDL report.
Surles, Tracy	01-35	Please provide an explanation on how the CBODu/organic nitrogen, N/C and C/oxygen ratios were derived/selected.	The CBODu/organic nitrogen ratio (or C/N ratio) was determined through an iterative process, starting with the widely accepted Redfield Ratio, and then adjusting the initial value through calibration. The resulting CBODu/organic nitrogen ratio (or C/N) was twice as high as the Redfield ratio. This can be justified by the fact that the C:N ratio of overland organic matter can be as high as 4 to10 times the Redfield ratio (Lunsford, 2002). The ratio C/Oxygen=2.67 is a stoichiometry constant (Chapra, 1997).

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-36	Given that organic nitrogen represents 26.4% of TN generated by the GWLF, explain how it is reasonable to justify the high CBODu/organic nitrogen ratio by saying the organic nitrogen is relatively diminished.	When the report stated that "the organic nitrogen is relatively diminished", it meant that in comparison to carbon, nitrogen is relatively diminished (a small portion of organic matter is nitrogen). Although, organic nitrogen is a significant part of the total nitrogen load as mentioned in your comment it is not a significant portion of the total organic load which also includes organic carbon and phosphorous. This is consistent with the fact that the C:N ratio of the overland organic matter can be as high as 4 to10 times the Redfield ratio (Lunsford, 2002)
Surles, Tracy	01-37	For which dates during the calibration and validation period is monitoring data available?	Data are available for the following dates: 05/15/91, 06/20/91, 07/09/91, 08/12/91, 09/09/91, and 10/09/91. EPA has included this data in an appendix to the report.
Surles, Tracy	01-38	Why does the model not consider the loss of sediment due to high flow conditions?	The model is conservative in that it does not consider loss of sediment due to high flow conditions. This is part of the implicit Margin of Safety included in the loading.
Surles, Tracy	01-39	How does the model account for the oxygen depletion that occurs to the land-based flows as they pass through the marsh during the summer?	See response to 01-05.
Surles, Tracy	01-40	Why was GWLF trend: nutrient information used instead of instream water quality and flow measurements?	The GWLF model was used to predict watershed contributions over time, in order to generate inputs for the predictive sediment diagenesis model. In-stream measurements were used to test the model (through calibration and validation), however, they're insufficient to provide an accurate input time series for the sediment diagenesis model (because they are not reflective of a wide range of hydrologic conditions). The GWLF modeling framework also enables a source-based analysis and allocation to be made.
Surles, Tracy	01-41	If the model does not explicitly account for the impact of groundwater how can there be a base fresh water flow? In the absence of a net advective flow, the water below the dams would be saline. Why then is the fresh water average criteria used for judging the model attainment and developing the TMDL?	The text in the report will be clarified. Groundwater contributions of flow and nutrients were predicted by the GWLF model, however, an explicit groundwater model was not implemented. In the absence of net advective flow, the salinity of the water below the dams would be dependent on salinity levels in Delaware Bay. Please see responses to comment 3

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-42	Please explain the enormous change in baseline TP between the 1998 model and the current draft TMDL.	The discrepancy between the 1998 and current model baseline TP values is attributed to two factors. First, the load used in the 1998 model was based on a low-flow condition, while the current model is based on variable hydrologic conditions (including all the actual storm events for the time period in addition to the low-flow conditions). Thus, the newly estimated load is expected to be significantly higher than the previous estimate. Second, the low phosphorus load estimated for the 1998 model was based on Ritter and Levin's method which uses an extremely high N:P ratio of approximately 57.0. The N:P ratio simulated by the GWLF model corresponds with the widely-accepted Redfield Ratio, which is less than 10.0. According to Wiseman, et al, 1999 (see reference list), the N:P load in watersheds should be close to the Redfield Ratio. Thus, this ratio was used as the basis for phosphorus predictions from the watershed.
Surles, Tracy	01-43	Please explicitly note that the TMDL does not limit the flow from the MOT plant.	The TMDL establishes a specific loading from the MOT facility. The permit for the MOT facility must reflect the loadings called for in the TMDL. If the permitting authority chooses to allow the flow from the facility to increase this would need to be compensated via a reduction in the discharge pollutant concentrations.
Surles, Tracy	01-44	Data are available for the particular sampling events, and the model produces output on a continuous basis, allowing direct comparison of the model with each data set. The TMDL compares averages of the model and data over several months. The model could be grossly in error on the high or low side of each sampling event. Even with the simplification several parameters in the calibration and verification sets don't agree with the model at all.	Data for the calibration and validation periods are not sufficient to perform an extremely detailed temporal and spatial calibration. Therefore, model calibration and validation results were evaluated through a comparison of the predicted and observed minimum, maximum, and average conditions during the period of interest (i.e., the time period used for evaluation of water quality criteria). The model results demonstrate that maximum and average concentrations, and in particular, minimum concentrations are predicted well. These minimum concentrations are the basis of the water quality criteria, and are thus the critical factor.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Surles, Tracy	01-45	There appear to be several miscellaneous modeling problems. The DO upstream boundary concentrations were changes. For the calibration and validation periods, the boundary conditions were generated using the GWLF model. For the TMDL scenario, the DO concentration was assumed to be equivalent to 80% of the saturation level at a water temperature of 28 degree C. The effect of the above changes can best be evaluated by running the TMDL scenario with the input data in the calibration file. However this cannot be done at this time because the files provided to the County do not allow us to run the WASP model. The TMDL report does not provide details of the hydrodynamic calibration. From the input file, the May to July tidal data were recycled for the entire simulation period. Therefore it appears that the May to July tidal data have also been used for the validation period August to October. The validation seems to be questionable due to the use of tidal data of a different period.	In the calibration/validation periods, the DO boundary condition was set equal to the same values used in the previous DNREC model to maintain consistency (DO was not predicted by the GWLF model). These boundary conditions were not applicable to the TMDL run because when a nutrient/organic matter load reduction scheme is implemented, the DO concentration of the upstream incoming flow is expected to increase. Thus, 80% of the saturation level at a water temperature of 28 degree C was used as the boundary concentration in the TMDL case for DO. A more accurate set of tidal data may provide more confidence in the model validation, however, the quality of the validation is not expected to change significantly. Because the configuration and parameterization of the model is the same for both the calibration and validation period (i.e., no additional parameter adjustment was made for validation period), and the model predicted water quality well for the validation period using the recycled tidal data, it is reasonable to assume that the tidal data for the calibration period approximated conditions for the validation period reasonably well.
Stuhltrager, James	02-01	The Appoquinimink River TMDL is based on land use data form 1992. Because much of the pollutant loading to the River is contributed by nonpoint sources that are effected by land use, the TMDL may not accurately reflect current environmental conditions. As soon as more current land use data is available EPA should consider amending the TMDL to more accurately reflect current environmental conditions. r	The draft Appoquinimink TMDL was based on 1992 land use data as stated in your comments. However, the model was run using the 2002 land use data EPA received during the comment period. This did not significantly change the TMDL as mentioned in the report.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Stuhltrager, James	02-02	A potential source of additional pollutants is the future growth that is projected to occur in the communities surrounding the Appoquinimink River. The proposal does not consider the forecasted increase in both point and nonpoint source contributions due to the county's growth. The Appoquinimink TMDL should develop methods to control these future impacts before they adversely affect the River.	The water quality standard for the Appoquinimink River may be achieved through a variety of allocation scenarios. The TMDL provides one such scenario, which neither requires a reduction in the current point source loading from the MOT nor provides a specific allocation to future growth. DNREC retains significant discretion in implementing the TMDL. As implementation of the established TMDL proceeds, DNREC may find that the applicable water quality standard can be achieved through other combinations of point and nonpoint source allocations that are more feasible and/or cost effective. If that happens, DNREC is free to re-run the model and to propose a revised TMDL with a different allocation scenario that will achieve water quality standards. See response to 01-17.
Stuhltrager, James	02-03	The proposed TMDL is silent as to the methods that will implement the necessary load allocations. By failing to include a plan for implementation, the TMDL may not attain the applicable WQSs.	An implementation plan is not one of the regulatory requirements of a TMDL. Section 5.0 of the TMDL report describes the best management practices that have been put in place.
Stuhltrager, James	02-04	In the absence of any enforceable point source reductions, the Appoquinimink River TMDL must identify the specific BMPs that will be implemented and the corresponding NPS reduction that can be expected from each.	Many of the nonpoint sources are actually associated with New Castle County's MS4 permit, therefore there is a regulatory program established to address these loads. The specific BMPs which will lead to the 60% reduction in storm water loadings should be identified in the implementation plan which should be developed by the state.
Stuhltrager, James	02-05	EPA has failed to establish separate WLAs for the various MS4s in accordance with EPA regulations and guidance.	In the TMDL all nonpoint sources were placed in the WLA for the MS4 permit. The remaining loads from nonpoint sources will be placed in the WLA for the MS4 at this time the state and county are mapping out the storm sewer lines. Once this work has been completed the loadings from storm water will be further segregated.
Stuhltrager, James	02-06	The proposed TMDL does not include an adequate MOS. The MOS does not include foreseeable factors that should be considered in the proposal. It is recommended that EPA use an explicit MOS.	The TMDL uses an implicit MOS and conservative assumptions to account for uncertainties in the model. The conservative assumptions are identified in the TMDL report.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Worall, Courtney	03-01	If the deadline for the TMDL is extended, I highly recommend holding another public meeting to explain the new data and what changes, if any that results in.	The deadline for the TMDL is not being extend.
Worall, Courtney	03-02	Please provide data regarding the implementability of the 60% reduction in nonpoint source load allocations.	EPA does not have data on the implementability of the 60% reduction in stormwater loads to the Appoquinimink. EPA has provided information in the TMDL on common best management practices for stromwater management and the possible load reductions expected with these measures.
Worall, Courtney	03-03	The point source load allocation should remain as presented in the draft TMDL.	The point source allocation in the final TMDL is the same as what appeared in the draft TMDL.
Worall, Courtney	03-04	EPA should segrerate the storm water point sources from the nonpoint sources and assign discrete allocations after DNREC and the county complete their mapping effort. EPA should allow the public and the permitees to work together to determine how this segregation should take place.	The forest and agricultural loads that were placed in the WLA of the MS4 permit in the TMDL due to the resolution of the model and the data available. Future work between the state and county should be able to refine these loadings.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Myoda, Sam	04-01	DNRECs Division of Water Resources is concerned with the nonpoint source loading rates generated by the GWLF model and the inability to adequately calibrate and verify the resulting water quality predictions due to the lack of a comprehensive data set. In 1997, additional monitoring stations were added to provide a comprehensive coverage within the watershed. DWR believes that it is more appropriate to use a post 1997 data set so that the model may be adequately calibrated and verified. In addition the use of the more recent data set would better reflect the current conditions in the watershed, eliminating the need ro adjust the proposed load reductions to reflect those reductions that have occurred since 1991.	Although a comprehensive water quality data set for the headwaters of the Appoquinimink River watershed was not available to perform a detailed calibration of the GWLF model, constituent loadings predicted by the model were validated through comparison of the WASP model predictions to monitoring data. The WASP model used GWLF model results as inputs. Thus, in order for the WASP model to accurately predict nutrient, DO, and algae levels, it was necessary for the GWLF loadings to be reasonably accurate. Because the WASP model results correlated well with monitoring data, the GWLF loadings can be assumed to be reasonable. Additional monitoring data in the headwaters would support refining the GWLF model calibration, however it's possible that load estimates would not differ from the current predictions. At the time the updated model was calibrated, only the MRLC landuse coverage (early 1990s) was available, therefore the 1991 time period was used for model calibration. Additionally, calibration of the receiving water model (WASP) focused on adjusting kinetic parameters that likely would not change significantly from the early 1990s to current conditions. The in-stream processes and relationships are not expected to change with changes to terrestrial land uses. Thus, the actual calibration year is not necessarily a critical factor. The primary changes would come in the land- based contributions (i.e., predictions from the GWLF model). Because the GWLF model is a dynamic, predictive watershed model that is source/landuse-based, it can readily be updated to reflect current conditions without the need for a full calibration. That is, the landuse distribution in the model can be updated to reflect current conditions, and new loadings can be predicted and applied to the receiving water model (without necessarily the need for recalibration.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Myoda, Sam	04-02	The GWLF output calculated the annual phosphorous load to be substantially higher than Ritter and Levin's rates. DWR monitored the outflows at Silver Lake and Noxontown Lake to determine actual nonpoint source loads to the upper boundary of the tidal river to serve as a basis for Ritter and Levin's calculations. This discrepancy needs to be addressed.	The discrepancy is attributed to two factors. First, the load used in the 1998 model was based on a low-flow condition, while the current model is based on variable hydrologic conditions (including all the actual storm events for the time period in addition to the low-flow conditions). Thus, the newly estimated load is expected to be significantly higher than the previous estimate. Second, the low phosphorus load estimated for the 1998 model was based on Ritter and Levin=s method which uses an extremely high N:P ratio of approximately 57.0. The N:P ratio simulated by the GWLF model corresponds with the widely-accepted Redfield Ratio, which is less than 10.0. According to Wiseman, et al, 1999 (see reference list), the N:P load in watersheds should be close to the Redfield Ratio. The Redfield Ratio is based on terrestrial sources which are the sources being recreated in the model and therefore the Redfield Ratio was deemed appropriate. Thus, this ratio was used as the basis for phosphorus predictions from the watershed.
Myoda, Sam	04-03	DWR's Surface Water Discharges section issues NPDES permits based on 7Q10 flow conditions. The dynamic model looks at a seasonal average and may overlook the critical periods. The steady state model used in the 1998 TMDL is more consistent with the 7Q10 and critical time period approach. DWR supports the EPA in recognizing that the point source waste loads will be maintained at their existing level.	The model used for TMDL development does not look at seasonal average conditions. It makes predictions at a sub-hourly timestep for the entire modeling period. Therefore, it predicts constituent levels for low-flow as well as for storm events. More importantly, the model makes predictions for critical conditions overlooked by a 7Q10 analysis (e.g., relatively low- flow conditions that follow a storm event). A 7Q10 analysis assumes minimal land-based loading inputs, however, these inputs (which are typically contributed during storm events) become the most critical factor even during low flow events, such as the 7Q10. Thus, the current modeling framework can be used to evaluate critical periods in more detail than a steady-state 7Q10 evaluation.
Myoda, Sam	04-04	At this time neither EPA nor DWR has sufficient data to determine the portion of water that is captured by the storm water system. DWR supports EPA in combining the WLAs for the storm water permits and the Las for the areas not covered by the storm water permits until adequate dat is obtained ro justify a discrete allocation to the storm water permits.	The forest and agricultural loads that were placed in the WLA of the MS4 permit in the draft TMDL can now be found in the LA. The remainder of the storm water loading has been lumped into one gross WLA for the MS4. EPA believes that the state, stakeholders, and permittees should further segregate this loading when the storm sewer mapping data set becomes available.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Myoda, Sam	04-05	The adjusted CBODu/CBOD5 ratio is significantly higher than monitoring data values.	There were no CBODu/CBOD5 data available during the study. Only CBOD20 was measured, as indicated in the dataset. The CBODu/CBOD5 ratio in the current version of the model was determined based on the CBOD decay rate of 0.1/day. In general, a high CBODu/CBOD5 ratio is associated with a low CBOD decay rate, which indicates that the organic matter in the water is relatively well stabilized and would impose less impact on the DO concentration. See Comment 1-31 for additional discussion on the CBOD rate.
Myoda, Sam	04-06	SOD is one of the major drivers affecting the DO levels in the Appoquinimink River, using this approach, and with a CBODu/CBOD5 ratio that DWR considers too high, the SOD values may also be too high, resulting in reductions that are greater than necessary to ensure State Water Quality Standards are met.	No in-situ SOD data were available for directly calibrating the sediment diagenesis model during the study. However, the predictive sediment diagenesis model was indirectly calibrated and validated through a comparison of the simulated DO, NH3 and PO4 concentrations with monitoring data. If the SOD, NH3 and PO4 fluxes simulated by the sediment diagenesis model were incorrect, then the water column DO, NH3 and PO4 would not have matched the monitoring data. Since model predictions for these constituents correlated well with monitoring data, this is not the case. The CBODu/CBOD5 does not have a significant impact on the predicted SOD value because the major source of organic matter that generates SOD is from the watershed (land-based) loading (where the CBODu/CBOD5 ratio does not play any role). Thus, the proposed reduction to meet the State WQS was not caused by the high CBODu/CBOD5 ratio.
Myoda, Sam	04-07	Total nitrogen is not considered only Total TKN. DWR would ask that EPA to consider a WLA for nitrogen that exists as nitrate and nitrite.	The WLA assigned for the MOT WWTP NPDES discharge (DE0050547) included only TKN, in order to be consistent with its current permit.
Bryan, Frank & Rhoda	05-01	Do not increase the WLA for New Castle County Water Farm #1.	The point source allocation in the final TMDL is the same as what appeared in the draft TMDL
Murray, Joseph	06-01	Do not increase the WLA for New Castle County Water Farm #1.	The point source allocation in the final TMDL is the same as what appeared in the draft TMDL.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Love, Susan	07-01	No reductions are called for in the load from the MOT wastewater treatment plant. The plant is currently in violation of its permit and trying to reduce its buffer requirements order to accept more flow per day. It is unclear how the load reduction of 60% will be accomplished. While it is understood that nonpoint source pollution is a major factor in the impairment of the Appoquinimink River, clean water quality gains can be made immediately by reducing the allowable nutrient contributions of the MOT plant.	Your comments regarding the performance of the MOT facility will be forwarded to DNREC and EPA's enforcement branch. As stated in your comments the TMDL calls for a 60% reduction from land based sources yet does not require a reduction in the MOT effluent. The TMDL model found that Appoquinimink was more sensitive to reductions in land based sources of nutrients. These sources represented over 90% of the nutrient load and must be reduced for the River to attain the applicable criteria.
Lang, Bryan&Rebecca	08-01	Do not increase the WLA for New Castle County Water Farm #1.	The point source allocation in the final TMDL is the same as what appeared in the draft TMDL
Whiteside, Warren	09-01	Do not increase the WLA for New Castle County Water Farm #1.	The point source allocation in the final TMDL is the same as what appeared in the draft TMDL
Mulholland, Chuck	10-01	We have learned of that New Castle County has approached EPA to increase their discharge in the Appoquinimink River from 0.5 mgd to 2.5 mgd without any prior advisory from our local government. We believe that a reduction from a single point source, the waterfarm, would more easily attain the water quality we seek to attain.	New Castle County did propose that the WLA from the MOT plant include an increase in its current loading . EPA ran the model with the increased WLA to the MOT plant and predicted that this increase in the loading from the MOT plant would cause a failure to achieve water quality standards. Thus, the allocation scenario selected for the TMDL provides for no change from the current loading from the MOT plant. The TMDL model found that Appoquinimink was more sensitive to reductions in land based sources of nutrients. These sources represented over 90% of the nutrient load and must be reduced for the River to attain the applicable criteria. According to the model, the River would be unable to attain the applicable criteria even if the MOT facility was removed. It should be noted that the TMDL provides only one allocation scenario. DNREC retains significant discretion in implementing the TMDL. As implementation of the established TMDL proceeds, DNREC may find that the applicable water quality standard can be achieved through other combinations of point and nonpoint source allocations that are more feasible and/or cost effective. If that happens, DNREC is free to re-run the model and to propose a revised TMDL with a different allocation scenario that will achieve water quality standards. See response to 01-17.

Appoquinimink TMDL Responsiveness Summary
Dec. 15, 2003

Commentor	Letter ID	Comment	Response
Waxman, Harry	11-01	Do not increase the WLA for New Castle County Water Farm #1.	The point source allocation in the final TMDL is the same as what appeared in the draft TMDL. The WLA was not increased for the MOT facility.
Chandler, David	12-01	Do not increase the WLA for New Castle County Water Farm #1.	The point source allocation in the final TMDL is the same as what appeared in the draft TMDL. The WLA was not increased for the MOT facility.
Baker, Bob	13-01	As a result of the "Hawes Case", the EPA and the State of Delaware should stop the process of developing TMDLs. The Court found that the agreement with the State of Oregon was null and void and that the state should stop imposing and implementing TMDLs on nonpoint source waters.	To the extent the commenter is arguing that the Clean Water Act does not authorize EPA to establish TMDLs where the sources of the pollutant loadings are nonpoint sources, the commenter is incorrect. In Pronsolino v. Nastri, 291 F.3d 1123 (9th Cir. 2002), cert. denied, 123 S.Ct. 2573 (2003), the U.S. Court of Appeals for the Ninth Circuit held that the Clean Water Act authorizes EPA to establish TMDLs for waters that are impaired by nonpoint sources.